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ENSILAGE:

ITS ORIGIN, HISTORY, AND PRACTICE;

WITH

EXPERIMENTAL TRIALS & RESULTS,

AND

ILLUSTRATED BY PLANS, &c.

BY

HENRY WOODS.

REVISED AND ENLARGED.

NORWICH: STEVENSON & Co., MARKET-PLACE.
LONDON: WILLIAM RIDGWAY, 169, PICCADILLY, W.
1883.

Price One Shilling, or by Post Thirteenpence.

ENSILAGE:

ITS ORIGIN, HISTORY, AND PRACTICE.

WITH AN ACCOUNT OF

EXPERIMENTAL TRIALS & RESULTS,

AT

LORD WALSINGHAM'S HOME FARM,

MERTON, NORFOLK;

AND

PLANS OF SILOS, SPECIFICATIONS, & ESTIMATES.

A LECTURE DELIVERED TO THE WAYLAND AGRICULTURAL ASSOCIATION,

BY

HENRY WOODS,

Author of "The Cultivation and Management of Underwood," "The Breeding and Management of Sheep," "Alleged Outbreak of Rinderpest amongst Sheep," "The Diseases of Sheep," "Abortion and Mortality amongst Ewes, &c."

NORWICH: STEVENSON AND CO.
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TO THE RIGHT HONOURABLE

LORD TOLLEMACHE, OF HELMINGHAM,

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HIS LORDSHIP'S PERSONAL MERITS,

AS A

PRACTICAL AGRICULTURIST,

AND

KIND-HEARTED, LIBERAL LANDLORD,

THIS TREATISE IS RESPECTFULLY DEDICATED,

BY HIS OBLIGED AND HUMBLE SERVANT,

HENRY WOODS.

INDEX.

PAGE
Preface 7
Introduction 9
Nomenclature 10
Antiquity of Practice 11
French Development of Ensilage 12
Silo and Practice of the Viscount de Chezelles 13
Ensilage in America 16
Blundering into Ensilage 18
An Ensilage Congress 19
Report of the United States Department of Agriculture 21
A Canadian Experiment 22
Ensilage in England 23
Successful Silo Experiments 27
Official Experiments 30
A Word with Scientific Objectors 30
The Merton Trials and Results 35
Silo Construction in England 39
Barn-Silos 41
Barn-Silo Experiments 42
Illustration—An Old Clay Built Barn converted into Silos 43
Overground Silos—Plans and Specification 46
Illustration—Plan of Four Silos under one Roof 49
Long Grass Ensilage 50
Value of Ensilage for Dairy Cows 53
Milk and Cream Test 54
A Trial with Ewes 56
Milk Analysis 57
Analyses of the Ensilage—Important results 58
Conclusion 62

PREFACE.

The vast practical importance of Ensilage, the cry for "Details" raised on all sides, and a conviction that the results of Lord Walsingham's Experiments teach some highly-valuable truths, induced me to prepare in the form of a Public Lecture the matter contained in these pages. The lecture, which was delivered before the Wayland Agricultural Association, on February 5th, 1883, was honoured by the attendance of a very large body of Agriculturists, including such representatives of the landed interest as Lord Walsingham; Sir R. J. Buxton, Bart., M.P.; W. A. T. Amherst, Esq., M.P.; T. Thornhill, Esq., M.P.; R. T. Gurdon, Esq., M.P.; with leading Tenant Farmers and Flockmasters.

Influenced by their kindly-expressed opinions, I have undertaken the publication of this pamphlet. I trust it may be a source of both pleasure and profit to farmers, and I shall esteem myself as well repaid for the time and trouble it has cost me, if it should enable them to diminish the losses attending the management of their pasture and other green fodder crops, and thus improve the yearly balance of their farm accounts.

HENRY WOODS.

MERTON,
THETFORD.

ENSILAGE:

ITS ORIGIN, HISTORY, AND PRACTICE.

INTRODUCTION.

MISFORTUNE has its uses as well as its sorrows, and as in our school days we were taught to believe, so in the experiences of our riper years we find it true, that Necessity is the parent of new ideas and methods for solving the complex problem of existence. The troubles that have beset British Agriculture in the course of the last ten years have exercised the thought and ingenuity of many minds, in the hope of finding some means of escape for the unfortunate sufferers. It is seen, and universally acknowledged, that two great causes, distinct and separate, yet acting each upon the other, have been operating against successful farming in the United Kingdom. One of these—the greater of the two—is the succession of disastrous seasons in which Husbandry has been carried on; the other, the severe competition to which British produce is subjected by our markets being freely open to the world. In the midst of the encircling gloom, many have looked to the Legislature for help. We have had a Royal Commission which has given us a report on the nature and extent of Agricultural depression, and one or two Acts have been passed on minor matters. But, as must obviously be the case, nothing has been done to touch evils which really have their source in clouded skies, and an absent sun. There was a time, perhaps, when some thought that Government might have it in its power to improve our prospects; but those persons, however strong their trust in sweet promises offered them, will ere this have learnt that "the ills" from which we suffer are such that no Government, whichever the Party constituting it, "can either cause or cure." Is there nothing, then, remaining, you will ask, but to endure patiently till the cycle of disastrous seasons has completed its round? Yes; it is possible, I think, for us in some degree to help ourselves; and it is with this conviction that I have undertaken to deliver this lecture. The subject is one that has lately come to the front, and is being roundly controverted. It is deeply-interesting to all farmers and graziers. The subject of which I have to treat is, "Ensilage: Its Origin, History, and Practice." I shall in the first instance impart such general information as I possess on each of these points, and then, secondly, place before you, for your thoughtful consideration, a description of a series of Experimental Trials conducted on Lord Walsingham's Home Farm, at Merton, with highly-instructive results, ascertained from analyses made by a well-known, able, and most competent Agricultural Chemist, Mr. Francis Sutton, of Norwich, the County Analyst.

NOMENCLATURE.

For the clear understanding of a subject it is needful that we have some little knowledge of its nomenclature;—that is, know what is meant by the names by which things are called. Without at all presuming to be an authority in the science of words, I may yet venture to explain shortly the meaning of the terms *Ensilage* and *Silo:* which severally denote the process, product, and structure, of which we are going to speak to-night. *Ensilage* is a term given to green or fresh fodder preserved in air and water-tight receptacles, and it also expresses the storing process; being used both as a verb and a noun. *Silo* is a word of Spanish derivation, adopted into the French, and signifies a subterranean place in which to preserve corn. In its relation to Ensilage, therefore, it means a pit or structure in which forage is packed. As to the derivation of the term *Ensilage*, some little controversy has been raised. It has been traced to a French, a German, and an American source; but most probably it is a corruption from the Spanish. Mr. G. A. Sala, in *The Illustrated London News*, December 2nd, enters a fuming protest against such a word "being pitch-forked into the English language." It seems, he says, to be an Americanism, probably a corruption from the German "Enisalzen," to pickle; or the Spanish "Ensalada," salted; from which the English word "salad" is derived. A writer in an agricultural journal humourously retorts on this idea, that "possibly *salad pit* for the receptacle, *pickling* for the process, and *cow salad* for the fodder, would be more satisfactory;"—to Mr. Sala!

ANTIQUITY OF PRACTICE.

"There is nothing new under the sun." We need not, therefore, affect surprise at the discovery that the practice of Ensilage is very ancient; — the practice, that is, of preserving produce in structures from which air and moisture are excluded. Professor Thorold Rogers tells us that it was known five centuries before the Christian era; it is mentioned by the poet Euripides, and described by nearly all the Latin writers on Agriculture. A contributor to *The Field*, with great research, furnishes abundant confirmatory evidence of this, in quotations from the old Historians and the Scripture records. There is, indeed, not the least doubt, that among the ancient Hebrews the practice of burying, or covering over, their corn was widespread. That it existed in the time of the Pharaohs any Biblical student would naturally infer from what is recorded of Joseph, and the provision which he made against the years of famine. There is also other trustworthy evidence, to which I see no reference made either by Professor Rogers or *The Field*. I allude to the Egyptian paintings and inscriptions brought to light from the mists of antiquity. These inform us that the grain was stored in vaulted chambers; the chambers being furnished with an opening at the top, reached by steps, into which the corn was emptied from sacks, and with an aperture for removing it when required. Thus, "History repeats itself;" and the antiquity of Silos and of a certain form of Ensilage is established. In the words of an American author: "The *system* of Ensilage is not so much a new dispensation, as one of the 'lost arts,' which, after the lapse of centuries, has just been re-discovered, improved, adapted to the requirements of modern civilization, and which is destined to be the means of producing a revolution in our agricultural methods."

FRENCH DEVELOPMENT OF ENSILAGE.

Ensilage has been long practised in Continental countries,—in Germany and Hungary more particularly,—and it is also not unknown in Russia. But the person who started the present system, or rather, perhaps, I should say, developed and modernised the older practice, was M. Auguste Goffart, a Frenchman. This gentleman, at his farm in the Department of the Loire-et-Cher, made his first experiment, with Indian corn, in 1852. It proved both economical and satisfactory. His silos consisted of large pits, 36ft. long and six feet deep, with stone and cement walls, and a paved bottom. He stored that year about 250 tons of green maize, depositing about 40 tons, mixed with one-fifth of its weight of rye straw chaff, in each pit. But his plan was not original. The thing is said to have been tried upwards of eighty years ago by an old German farmer, and it was certainly described by a German writer ten years before M. Goffart began his experiments. The idea is believed to owe its birth to a wet season, and the salting of cabbage in the family barrel. The farmer thought what was good for his cabbage might possibly not prove bad for his cut grass, clover, and vetches; he accordingly deposited them in a pit in the ground. The practice afterwards obtained a hold among his brother farmers. Their plan was to dig pits in the earth from 10ft. to 12ft. square, and as many deep; these were lined with wood, and puddled below and at the sides with clay. Into these pits they introduced their green crops of grass, clover, or vetches, after passing them under a chopper, or sometimes without any such operation. Every layer of four or five cwt. was spread evenly over the bottom; well-trodden down by five or six men; rammed as close as possible to the sides, with wooden rammers; sprinkled with salt, at the rate of one pound to each cwt.; and the whole covered with boards, or a well-fitting lid, with a foot-and-a-half layer of earth, for the more perfect exclusion of the air. Many years ago this preserved fodder was described as possessing excellent feeding qualities. From 20lbs. to 28lbs., mixed with chopped straw, was the daily allowance to cows, which were kept in fine condition throughout the winter, and gave "a rich and well-tasting milk."

SILO AND PRACTICE OF THE VISCOUNT DE CHEZELLES.

In July last, I had the honour of being accompanied from the Royal Agricultural Show at Reading, to Merton, by the Viscount Arthur de Chezelles, who much impressed me with his great intelligence and practical knowledge in matters of Agriculture; and it was exceedingly gratifying to me to receive his approval of our Merton Silos, though they differ in principle from his own (as you will find when I come to describe them). On this gentleman's estate, the Château Beaulleaume, Liancourt St. Pierre, Oise, France, where the practice of ensilage has been adopted on an extensive scale and in elaborate detail, there is probably the largest silo in Europe. With the pit is combined a great oblong grain shed; a plain, slate-covered, timber structure, on uprights, which are placed at a distance of 8ft. apart, and tenoned into an oak wall-plate running the entire length of the silo wall; forming what is commonly called a "Dutch barn." It is 72 yards long, 6½ yards wide, and 4½ yards high from the ground level. The floor is sunk some 12ft., and is paved with concrete and drained down the centre. The side walls, and one end wall, are lined with rough stones set in mortar, while the front is partly walled up, and has an inside door, through which trucks are run on rails to be filled.

In this huge cavity was stowed away last July the produce of 170 acres of various sorts of forage, mowed, carried, and cut into green chaff. From a graphic description written by a gentleman, a Correspondent of *The Times*, who visited the farm last October, saw the silo opened, and was enabled to judge for himself of the value of the fodder, we learn some interesting particulars respecting the Ensilage process, as carried on at that place.

1st,—As regards the cutting of the forage. This operation was performed by English mowing machines, followed by five men who loaded into carts, which delivered the green stuff at the side of the silo, upon the carriers of a powerful "Albaret" chaff-cutting machine; two men unloading and three men feeding; so that ten men were employed. The men worked by the job, and their rate of pay varied according to the character of the crops, from 8s. to 16s. per two-and-a-half acres. There was no interruption in the work. A chaff-cutter, which was driven by a 7 horse-power engine, continuously poured out "a green stream of food, that, like water, soon became level, through being trimmed and stowed by a couple of workmen." To give it compactness, bullocks, which, as you will probably know, are largely employed in farm work on the Continent, were walked over the pile twice a day, and a little salt was sprinkled between the layers. When the silo was filled, the forage was covered over with a stratum of light, sandy soil, about an inch-and-a-half thick. This superincumbent weight, of course, caused the mass to subside, and it became "nicely compressed; but scarcely more than is hay in a large stack."

2nd,—As to the opening of the silo, and the quality of its contents. Taken by itself, it might have seemed a rash act thus to stow away so enormous a quantity of green forage. But it was nothing of the kind. Previous experiments justified this daring confidence. The Viscount de Chezelles was only making wise provision for the coming winter, when the contents of the silo would be available as "keep" for the live stock of his farm, which consisted of 20 horses, 36 bullocks, 12C milch cows, and 1,200 sheep. On the 12th of October the silo was opened. The ensilage, of a brown-black hue, gave forth an agreeable alcoholic odour, and a cube cut from the mass, which was at once given to a yoke of oxen, was eaten "with relish, as a horse takes a mouthful of hay from the hand." It is the practice to cut away the ensilage as it is wanted, in the same manner as hay is cut in trusses from an ordinary stack. A sample of this ensilage was exhibited at the last Norwich Fat Stock Show, where, no doubt, several among you availed yourselves of the opportunity to inspect it. It ought to be known that this sample was six weeks old, and had been partly spoiled, by detention at the Custom House and prolonged exposure.

Analysis—Some figures by Mr. F. Woodland Toms, [published in the *Farmers' Almanack* for 1883, p. 82-83,] a well-known Analyst, so clearly show the high feeding value of this ensilage that I take the liberty of quoting them. The following tabular statement sets out the per-centage composition of samples of the fodder, consisting of trefoil, lucerne, tares, and grass :—

Volatile matter:		Per cent.
Water		50·30
Free acetic acid		1·20
Alcohol		1·80
Solid matter:		
Albumenoids*		9·12
Ammonia		0·06
Fatty matter		2·07
Soluble Carbo-hydrates:		
Sugar (maltose)	2·94	
Starch and digestible Cellulose	2·23	
Pectoris substances:		
(Gum, mucilage, &c.)	10·32	
	——	15·49
Insoluble carbo-hydrates (fibre)		14·35
Mineral matter (ash)		5·61

These samples were contrasted with two others of dry lucerne, analysed by Dr. Von. Wolff, of the Honhenheim Imperial Experimental Station, Germany, (the one dried with care on a barn floor; the other dried in the field, in the ordinary way, but subjected to the action of a slight shower of rain, and to a thunderstorm,) and the results are stated as follow :—

	Ensilage.	Carefully-dried Lucerne.	Field-dried Lucerne.
Albumenoids	18·35	17·00	14·94
Fat, Soluble Carbo-hydrates and Alcohol (if any)	38·95	43·80	44·22
Ash	11·29	7·39	6·94

---

* Containing nitrogen, 1·44 per cent.

In a note, Mr. Toms points out that, "contrary to generally accepted opinion," his experiments lead him to believe that "the sugar formed by the fermentation of ensilage is not 'grape sugar,' or 'glucose,' but sugar of malt, or 'maltose.'"

ENSILAGE IN AMERICA.

If there is anything in the world that can be turned to a profitable account, that go a-head people, our own kith and kin across the seas, are sure to light upon it, and, as they would say, "lick all creation" in their efforts to achieve success. With them, however, as with others, ensilage had an exceedingly modest germ. At first they simply clamped the fodder, in heaps six feet high and fifteen feet long, and partially excluded the air by a covering of earth. After a time, these mounds were superseded by substantial and useful structures. M. Auguste Goffart had published the results of his experiments; a translation of his book was circulated in the States; and American farmers, plodding, hard-headed, persevering fellows, at once tested the theory. They claimed for ensilage that it is the best of all winter foods for stock, especially milch cows, and they having written several big books, many other pens were soon brought into work, so that there is now extant a most copious literature on the subject. As might be supposed, in a people so intelligent and ingenious, their silos are singularly varied in form, material, and arrangement. Some are exceedingly simple and economical structures. One at Virginia, holding 150 tons, is described [in the *American Country Gentleman*, 27th July, 1882] as octagonal in shape, 25 feet in diameter, and excavated seven feet. It is built within another octagonal building, around which there is a row of cattle stalls. This silo, at the last experiment, was filled from the floor on the ground line, and the forage, which was machine cut, was evenly spread and solidly trampled by a man, a boy, and a horse. The contents, which were perfectly preserved, supplied a flock of sheep, over twenty horses and colts, and a large stock of cattle and milch cows. After three years' experience, the farmer says, "I have seen nothing, nor have I heard anything, to abate one jot or tittle of my faith that in ensilage shall the farmer find the boon which agriculture has sought from science in vain."

At Groton, Massachusetts, Mr. James Lawrence [*American Country Gentleman*, 12th Dec., 1882] made a silo in an old barn. The dimensions were—Length, 66 feet; width, 12 feet; depth, 16 feet. It was divided into three compartments, each holding 97 tons of compressed ensilage. The lower half of the walls was of concrete; the upper of two-inch plank. Ensilaging began September 25th, 89 days from the time the seed was sown. The corn (maize), as cut, was laid in loose bundles on carts arranged for the purpose, conveyed to the cutter, and chopped into half-inch lengths; thence it was carried by an elevator into the silo. It took three days to cut the crop and fill one compartment and the half of another. Rye straw was spread over the top of the mass, planks crosswise and quite close together were laid on the straw, and above all boxes filled with sand (sand being used to bed the cattle), giving a pressure of 1,300 lbs. to the square yard. Fifty-eight days after the filling the silo was opened. The fodder for one-half inch under the straw was brown and musty, like brown bread. Under that it was pale green in colour, with a fragrant aromatic smell and taste. The cattle, 70 in number, ate it willingly and readily. To each milch cow 40 lbs. per day was given. In addition, 8 lbs. of chopped hay, 4 quarts of bran, and 4 quarts of mixed meal and oats, were fed to the older cattle.

Experiments, full of interest, are reported by the score; but my time is limited, and I must pass them over. I will, however, mention that Colonel Cameron, a well-known breeder of shorthorns, in Vermont, has taken up the system with much caution, and he, having compared most carefully the weight-results with what he obtained under the old system, reports that "he has obtained an advantage of about eight to ten per cent. in the feeding power of the silo food." Compared with most of the reported trials, this is a very modest-looking advantage, but it is at least a tangible and appreciable one—intrinsically most valuable, on account of its perfect freedom from any suspicion of exaggeration.

There are two very important factors in results, as to which, in the majority of cases, not much has been said. These are the condition of the fodder when ensilaged, and the method of feeding adopted. As to the former of these, Mr. John M. Bailey, one of the principal pioneers of the system in America, observes: "I am more than ever satisfied that the proper time to cut the corn-fodder is when it is in blossom." As to the latter, he says: "I remove from the silo 50lbs. of ensilage (about one cubic foot) for each grown animal daily, mixing 1lb. of oil-meal or wheat-bran to every 10lbs. of ensilage. . . . There is in every 50lbs. of ensilage about 40lbs. of water, nearly all the animals require." Of the highly-nutritious value of the food he gives the strongest possible proofs. Some of his Cotswold ewes brought lambs weighing from 10 to 15½lbs. each when born; his ewes sheared as high as 16lbs.; and his whole flock averaged 11lbs. 7oz. His Oxford Downs averaged over 12lbs. of wool each. The young cattle and calves, he states, never grow as rapidly in summer upon good pasture as they do in winter in a warm stable when fed upon ensilage and oil-meal.

BLUNDERING INTO ENSILAGE.

Now, it often happens that men "blunder" into some of the great discoveries of life; and, in the course of my studies on this subject, I have come across an interesting and amusing instance of a farmer "blundering" into ensilage. The story is from the other side of the Atlantic, and, therefore, it may with propriety be introduced here. The son of a professional man was given the management of a large farm in Southern Kentucky. About 12 acres of low, wet land, which was drained, ploughed, and planted to corn July 20th, gave a fine growth of stalks, fully 20 tons to the acre; but as the season was well-advanced, and it was not likely to mature, and as, moreover, there was a sufficiency of fodder to winter the stock, the youthful manager looked round for some way to utilize this great mass of green vegetable matter. It occurred to him that by cutting up the corn-stalks, and rotting them in an old, walled-in, underground ice-house there was on the place, he might make a fine lot of manure for his tobacco fields. He, therefore, set to work with a machine, cut the stalks into two-inch pieces, and packed them solidly down in his ready-made "silo," to help the fermentation as he supposed. The ice-house was filled in a couple of days; and was covered with earth. The following March he went to empty the house, and he says, as we may well believe, that great was his astonishment to find the contents perfectly preserved. Cows, sheep, and mules were given the "food" with good results; his satisfaction was complete. During the time they were being fed on this fodder a great many people went and inspected it, and the general impression may be inferred from a statement of the young Kentuckian farmer, that "some laughed, some ridiculed, and some swore; but none solved the mystery!"

AN ENSILAGE CONGRESS.

It is the nature of some people to be doleful, and to hold that it is impossible for others to succeed where they themselves happen to have failed. This reflection is suggested by a short letter in *Bell's Weekly Messenger*, the other day, from Mr. T. Duckham, M.P. for Herefordshire, giving, as he said, "a verbatim copy" of the opinion of a friend of his in the State of Maine, to whom he had written for information, respecting the advantage of ensilaging. That authority, with whose name we are not favoured, states, that he has "fed ensilage in greater or less quantities for three seasons as a substitute for roots; but the cost is too great for the nutritive value it contains;" therefore, he does not recommend any one else to try it. He curtly dismisses the whole subject by stigmatising it as a "fever." In this he undoubtedly shews himself to be a good judge, because it is not only a *fever*, but one of a highly-contagious character, which, even if it originated, as he alleges, with "theoretical farmers," has rapidly spread among the most practical and successful agriculturists in all parts of the vast territories of the United States. But what is the actual worth of an opinion which is contained in no more than ten lines-and-a-half of ordinary newspaper type? I need not speculate on this. In point of fact, I have merely introduced the matter here to justify my asking your attention (if any apology were needed for so doing) to the proceedings of an Ensilage Congress, held in New York, just twelve months ago, and which probably has since re-assembled. The Congress consisted of a number of farmers, who, having built and filled silos in different parts of America, desired to meet to compare notes. Its thoroughly practical character was further attested by many of the members exhibiting samples of butter and milk produced from ensilage, with specimens of the different kinds of fodder ensilaged. Each member gave his own experience, and there was a most remarkable consensus of opinion as to the value of ensilage. Take one or two experiments, typical of many others; and be it remembered that in all cases names are published to the world. A cow, which had been fed on hay and grass, was put on ensilage for nineteen days, receiving the usual quantity of food she had been accustomed to get. The milk increased at the rate of two pounds per day, and the colour of the butter very materially improved. Previously the butter was perfectly white; subsequently it was quite yellow. In the preceding summer a member who found his pasturage run short, and was also out of ensilage, cut oats, when in blossom, from five acres, put it in a silo, and subjected it to pressure. It sustained his milch cows (about 80 in number) for a space of six weeks. Another member who had fed out of silos for five years never had any trouble. He mentioned one remarkable fact. In the spring of 1881 he was milking 56 cows and sending 15 cans of milk to the city every day. The cows were fed on ensilage, with two quarts of barley meal added. About the middle of June he turned them out among grass from six to twelve inches high. The yield at once decreased from fifteen cans to eleven, and the cows did not begin to gain until he put them back to ensilage again in the fall. Now, this Congress, which was in every sense of the term a representative gathering, having sat for two days, and fully considered the matter, was clearly of opinion that time and experience had settled all the economic and scientific questions which are involved in the controversy, favourably to the universal use of ensilage; and that the only questions remaining for discussion were minor ones, such as the best method of constructing silos, what is best to ensilage, &c. After an exhaustive debate, the aggregate result was summed up in the following resolution, which was adopted unanimously:—

> " *That it has become a well-established fact, by six years'*
> " *successful use in this country, and by the concurrent*
> " *testimony of many intelligent farmers, that the Ensilage*
> " *System is of great advantage to the Farming Interest, and to*
> " *all mankind.*"

REPORT OF THE UNITED STATES DEPARTMENT OF AGRICULTURE.

A still more important proof—I should think the strongest possible evidence—that this question has come within the range of Practical Agriculture is given in the fact that an Inquiry has been instituted by the United States Department of Agriculture, at Washington, into Silos and Ensilage throughout the States and Canada. The information collected is embodied in an admirable report. From it we glean a number of useful particulars. As to the location of the silo, we learn that this is not an essential point; local circumstances may determine whether it should be below or above, or partly above and partly below, the surface. The form of silo in vogue is a rectangular, horizontal section; but the cylindrical form is recommended as preferable. On the point of the extent to which the ensilage may settle under pressure, the report states that if the silo is not filled too rapidly, and the treading is not too slight, the settling will not exceed one-fourth. A layer of straw or hay is not necessary for a covering, boards or planks placed directly on the ensilage being found sufficient. In nearly all cases the loss by decay is very slight. Generally the ensilage has kept perfectly for several months, shewing no deterioration while any remained in the silo except where exposed for a considerable time. It is better not to uncover the whole silo or the compartment of a silo at once, but to expose a new surface each day. Ensilage has been fed to milch cows more generally than to any other class of stock, and no unfavourable results are reported. There is no doubt that in America the greatest value of ensilage will always be found in this connexion. Several feeders consider it equal in value to one-third of its weight of the best hay, and some rate it higher. Its effects on dairy products are signal. There is a marked increase in the quantity, and improvement in the quality, of milk and butter, after changing from other food to ensilage; corresponding with the effects of a similar change to fresh pasture. Ensilage has been given to all classes of farm stock, and its value in this respect is also proved. The daily ration to cows giving milk is stated at from 50 lbs. to 60 lbs., with some dry fodder and grain.

A CANADIAN EXPERIMENT.

Before I return to Europe, let me give you the details of a Canadian experiment, as reported by Mr. John Rae, to *The Standard*, last December. It was made by a Boston gentleman, Mr. Peirce, on an admirably-managed Dairy Farm of considerable size, in an Eastern township of the Dominion of Canada, close to the boundary between Canada and the State of Vermont. In 1881, Mr. Peirce gave his attention to ensilage for the first time. He prepared about two hundred tons of it as winter food for his stock. The experiment was so very successful that last year, early in September, he stored up as much as seven hundred tons. The crop was maize, which stood in the fields very thick, about six feet high, and yielded, it is said, at least twenty-five tons to the acre. When mown, the maize was immediately carted to a steam-power cutting machine, which with great rapidity cut the green stalks into pieces of about three-quarters or one inch in length, and carried them into a large wooden funnel, through which they were discharged into the silo, where two or four men were employed in levelling, whilst two others on horses rode over and packed down the contents. The pit was a large one, dug in the ground, and lined with stone, brick, or planks of wood; with walls, either of wood or stone, raised to a considerable height above the surface. When the pit was filled, as far as possible, the ensilage was covered with boards heavily-weighted. Whenever any portion was removed, the boards and weights were taken off a space sufficiently large to allow of a perpendicular cut being made, as in a haystack, to the depth of a foot or more, when the boards and weights were replaced, as before, until another supply was required; then the cutting was continued to the same depth at the other end of the pit. Thus the air was altogether excluded from the great body of the fodder.

ENSILAGE IN ENGLAND.

In speaking of our own country, I will begin by observing that I suppose it will be allowed that in the winter season, when natural pasturing is an impossibility, the nearer we can make our feeding approach to the condition of summer grazing, the better it will be for the health of our stock, and the more may we expect them to thrive. A nutritive diet pure and simple is not sufficient. The food we give must be of a certain bulk, as well as possessed of flesh-forming properties. Good hay is a food of this description; but, as it requires "making," it is in a sense an invented article of diet. I, therefore, say in passing, that ensilage is not to be put aside on the mere ground that it undergoes what may be called a process of manufacture. On the contrary, it constitutes a diet that differs very slightly from the food which Nature herself provides in the summer time. It is a natural food, which has only undergone a slight alcoholic fermentation; the effect of excluding the air from it, by which means alone it is preserved from decay. Into the chemical action that goes on through its being stored away in the pit, vault, magazine, or silo, whatever the name given to the hermetically-sealed receptacle in which it is preserved, it is not my purpose to enter. I have thus far confined myself to the practical economy of ensilage, and this point I shall endeavour to keep steadily in view throughout my lecture. Not for a moment let it be supposed that ensilage is to be a substitute for grain, or that its adoption here will dim the pastoral glories of our land. But it has uses, the value of which require only to be rightly understood to be fully appreciated. "Live and learn" was the motto adopted by *The Times*, some three months ago, in calling attention to the importance of the subject in a masterly leading article;—and here suffer me to say that I think we, agriculturists, are greatly indebted to our premier journal, for the valuable information it has gathered together on this subject, and the powerful assistance it has rendered to the agricultural community in breaking down the prejudice and opposition which had been displayed in some influential quarters. "Live and learn" we must, if we are to keep our place in the march of Civilization. The law of Progress is operating in every department of human life. Is Agriculture to be the one solitary exception? Does it stand in no need of the aids of modern scientific investigation and discovery? We know that no profession, no industry, in the country would more thankfully welcome any device by which the cost, the trouble, the risk, the loss, attending its operations were reduced. More than ever is it now desirable that we should turn our attention to the production of a greater quantity of beef and mutton. Grain must, to all appearances, for many years, fetch low and unremunerative prices. But the American "scare" respecting the importation of stock is fast subsiding, if it has not already quite disappeared, and it is now seen that we need fear no Foreign competition in regard to either cattle or sheep. Unfortunately, the number of live stock upon our farms has decreased, and is very deficient. This deficiency entails another serious consequence. It diminishes the yield of our cereal produce. A larger supply of grazing stock would mean a more remunerative acreable money value of corn, the production of which would be thereby increased. One means of securing this object would be to prevent the waste that now yearly occurs to our forage crops from climatic causes. Hay, of course, is a most excellent and nutritive food, when secured in good condition; but, as we are told in a proverb that seems now to have become almost a sarcasm, we must "make hay while the sun shines." In other countries heat and drought have been the predisposing causes tending to the introduction of silos and the practice of ensilage. In England, on the other hand, cold and wet are our great foes. There are our roots, it may be said. Yes; and invaluable they are. They, however, cannot supply all our need. For our cows in winter we want a food which will not interfere with the quality of our milk, cream, and butter, as mangolds, swedes, and common turnips do not unfrequently. Butter of superior quality will always command a good price in the market, and do you doubt that, if the public could always be guaranteed a butter devoid of the objectionable "turnip taint," to remove which so many quackeries are advanced, dairy farmers, who have now no alternative but to use turnips, would find their produce rise considerably in value? In this relation alone ensilage may be found of the greatest service.

But there are other matters which sorely press upon the farming community. What vast devastation do we see constantly overtaking our meadow lands through flooding! Take, for example, the lands lying in the river valleys—the Thames, the Trent, or, nearer home, the Yare and Waveney—large tracts of which are periodically submerged. The grass may be in a fit state for cutting, or it may be cut, and partly or wholly made into hay, when the rain descends, and the waters rise, and the crops are ruined. If, instead of having to encounter this risk, the grass was carted away as it was cut, and converted into a good and nourishing food, how many thousands sterling would annually be saved! Even supposing that it was considered undesirable, as of course it would be in many cases, to convert the whole crop into ensilage, such mode of treatment might be limited to those portions which had been more particularly subject to inundation; and the saving in that case would be incalculable. Moreover, those who have had any experience in the matter know well how much more difficult it is to make hay from grass grown on irrigated or flooded land than from that on sound pasture; because such grass contains a much larger amount of sap, and is so treacherous in character as often to over-heat when believed to be stacked in thoroughly good order. It is also a not unimportant point that floods are now of greater frequency, and severer in form, than formerly. Obviously, the meadow land which is subject to these inundations greatly deteriorates in value, through the consequently coarser texture of the plant it grows. Such grass every year becomes of less value as hay, and it is, I submit, a matter for the grave consideration of the owners and occupiers of these lands, whether it would not be a profitable investment to build silos and go in for ensilage, especially if it is shewn, as I hope to shew you later on, that even coarse and inferior grasses may be advantageously ensilaged.

Apart from the extraordinary losses by floods, there are others not less serious. These arise from the difficulties that usually attend the getting up of our layer hay. You know very well in regard to red clover, cow-grass, or sainfoin, that to retain the leaves of the plant in as green and perfect a state as possible during the hay-making process is an object to be kept steadily in view. If, however, the weather is hot and parching, these tender leaves become dry and brittle, and crumble into dust, in the course of gathering, loading, unpitching, and stacking. Through this destruction of the finer parts, a considerable weight of hay is either lost or greatly deteriorated in quality. Then take the converse case of showery weather; and it is one of the peculiarities of our sea-girt Isle that it presents us with great barometrical extremes. The leaves, instead of crumbling into powder, will blacken, mould, and rot, when the loss is equally great both in weight and quality. Therefore, I repeat, without for a moment recommending you altogether to discontinue the practice of making hay with these grasses, that I wish you to consider seriously how far it will be to your advantage to convert a portion of your grass into ensilage; feeling confident, as I do, that you may secure a valuable feeding material at a relatively small cost, with the advantage of being able to cart your crop in any condition except actually wet.

Many other considerations might be suggested why the most patient thought and investigation should be given to this question. The whole situation is, however, briefly and forcibly expressed in the closing paragraph of a *Times* leader, published a month or so since :—" The year's Returns of British Agriculture impart a critical value to any discoverable and ascertainable method of securing us from these losses. The returns do not show so much difference as might have been expected in this year, compared with the last, but in one point they show a very great difference to take place in a twelvemonth. The cultivated area of England shews an increase of more than a hundred thousand acres, and a large part of this increase is due to the reclamation of moor land. It appears, too, that agriculturists, who have been boxing the compass latterly, trying their luck first with wheat, then with barley, then with oats or potatoes, have been returning to the cultivations specially necessary for the dairy and for feeding cattle. No wonder they should. In wheat we do but share the market of the whole world. A few rainy days spoil the colour of our barley and reduce its value for malt. Potatoes lead us a continual dance. They either rot or are so abundant as to be unmarketable. But we all use milk and butter, and all who can afford it eat beef and mutton, and in these matters the English producer must ever retain a certain advantage. It cannot ever be said that the market is fully supplied with these articles, or that they are even reasonably cheap. They are at the mercy of the skies. What with drownings and what with droughts, it must be said that there is hardly an even chance of a good hay harvest. Sometimes there is but little to cut. Sometimes there are crops heavy enough if they could only be secured; but they are not. The discovery mentioned above (Ensilage), for discovery it is in fact, and to English intelligence, comes in the very nick of time, to place our dairies, our grazing farms, and our stables on a more satisfactory footing. It really is something not to depend on the haystack, which, in spite of its homely and solid look, is a deceitful and fickle thing, quite beyond calculation, sometimes shrunk up, sometimes burnt black, sometimes a woody mass, with all the strength and flavour washed out of it. There is hope in the silo, un-English as it sounds, and we trust it will immediately receive a full and fair trial."

SUCCESSFUL SILO EXPERIMENTS.

In several of our Home counties, and also in the Principality, during recent months, the system has been tried by a few enterprising gentlemen and farmers. So far as our own county of Norfolk is concerned, I am not aware of any other experiments than those by Lord Walsingham. But a small number of our farmers have some practical acquaintance with the subject. It will be in your recollection that last year a party of gentlemen from East Norfolk made a trip to Holland, to gather some useful information about Dutch farming, which they will probably turn to good account. Among the farms they visited was one (Mr. Van der Briggen's) on which were some brick silos, twelve feet square and nine feet high, and where the cows, which were fed on ensilage, were seen to be in a most thriving condition, giving a larger quantity of milk than cows not so dieted. The Special Correspondent who accompanied the party states, that at the close of the visit the practical comment made on the subject was, " Some of us will try that plan in Norfolk," which promise I, for one, hope will be carried into effect. Meanwhile, let us glance briefly at two or three of the experiments made in this country; the facts concerning which are derived from public sources of information.

Hampshire.

A Hampshire gentleman (to whom I am indebted for the particulars of the experiment), in the autumn of 1881, ensilaged 4½ acres of hop clover and Italian rye grass in a small experimental silo, 6ft. long, 6½ ft. wide, and 6½ ft. deep. It was a miserable crop, but it made capital fodder. The experiment was encouraging. Last summer about 70 tons of meadow grass were ensilaged, with perfect success. The produce of five acres, which was cut and carried in heavy rain, came out much darker in colour than the rest which was carried in fine weather; but was said to be equally good fodder. This ensilage, the Analyst (Mr. Toms) described as "a very valuable feeding stuff." He added, "In composition, its dry matter closely resembles that of hay of good quality; indeed, the albumenoids, or flesh-formers, are considerably higher than in Dr. Voelcker's averaged analyses of hays."

Kent.

At Pagenhurst Farm, Staplehurst, Mr. Henry Hoare has constructed a couple of stone and mortar silos, with cement covered walls. They are each 10ft. square and 10ft. deep, built side by side, the two being separated by a partition wall. The cost is said to have been about £40; no roofing being required, as they are built within a large shed or barn. Some fifty tons of trifolium, the produce of about three acres, were last year ensilaged. It was estimated that this crop would have yielded about eight tons as hay, whereas it weighed as ensilage ten tons. The cows took the food readily, and throve upon it. They improved in condition, and their butter became richer in tint, flavour, and quality. Both Mr. Hoare and his bailiff pronounce the experiment to have been perfectly successful.

Suffolk.

One other case nearer home; from Colonel Tomline's model farm, Orwell-park, in the neighbouring county of Suffolk. In the early part of last year a silo, 26 ft. in length, and 12 ft. in width and height, was built under the side of a hill, with an opening at each end; one for filling, on the ground level; the other, for extracting the fodder, below the level. The walls and floor were of concrete (the former a foot or more in thickness). In July, the produce of eleven acres of oats, in the green state, was passed through the chaff-cutter, and stored in the silo; eight men being engaged upon the work, which was carried on in showery weather and completed on August 12. The covering consisted of three loads of grass and one load of straw, with planks weighted with boxes of stones, bricks, and shingle—about 15 tons altogether. On the 1st of December the silo was opened. The outer coating of the ensilage was mouldy and rotten, but within it was bright, cool, and moist, and gave off a strong alcoholic odour. It was mixed with about an equal quantity of chaff, and given to the stock. Some took to it at once; others, more fastidious, at first touched it daintily, but soon acquired a taste for it, and "ate it with avidity." With regard to the effects of the food upon the cows, Mr. Henry Stevenson, the farm bailiff, reports as follows:—" The milk which the cows gave was vastly improved, the cream was thicker, and the butter came out a beautiful rich, natural colour, and of very fine flavour, rivalling in sweetness that which is produced from cows fed on the finest pastures in the early spring."

OFFICIAL EXPERIMENTS.

Official experiments, the first in these islands, have just taken place in Ireland, and the Scotch Highland Society is about to prosecute others. These Irish experiments were carried out under the direction of the Board of National Education, Dublin, by Professor Carroll, who has reported the results to His Excellency Earl Spencer, by whose orders they were instituted. The Professor disposes satisfactorily of a number of adverse opinions, and thus sums up his own: — "We have not had sufficient experience of the system in the British Isles to determine whether it is worthy of general adoption here. I am, however, of opinion that the successes of the Continental and American farmers are sufficient to *warrant our trying it on an extensive scale in these countries, and the measure of success of our experiments at the Albert Farm strengthens my opinion on this point.*"

A WORD WITH SCIENTIFIC OBJECTORS.

It is not at all to be wondered at, considering the habitual cautiousness of Englishmen, that so revolutionary a change in our system of Agriculture, as Ensilage must produce, should excite a considerable amount of opposition, even in quarters where we have been accustomed to look for enlightened encouragement to progress. Professor Thorold Rogers observes, [in an article in *Macmillan's Magazine* for December, 1882, p. 114,] "the advocates of the new system have had to encounter considerable criticism of that dogmatic kind which scientific people are apt to employ against anything which they do not find out for themselves;"

and (says an agricultural paper) "it is a curious fact, that while many scientific gentlemen, numerous professors in agricultural colleges, and eminent chemists, denounce this system of Ensilage as unworthy the time and attention of the agriculturist, yet numbers of practical farmers have, notwithstanding, proceeded to build silos, store fodder crops, and give ensilage to their live-stock, with almost unvarying success. Surely the best theories are those which have some foundation in actual practice." For a time many anxious eyes were turned to the Council of the Royal Agricultural Society, in the hope that it would move. But it held back. We must all be ready to credit the members of that select body with a very earnest desire to to do all in their power to advance the agricultural interests of this country, and to promote anything likely to tend to the advantage of farmers. They have not, however, always been happy or lucky in the experiments upon which they have entered; as, for example, in spending between £1500 and £1600 upon testing what to so many sound and practical men seemed a chimerical idea: whether wet hay might not be dried by machinery, and spoilt grass be converted into good hay. Probably the serious failure which, in the opinion of their own judges, that experiment proved, has had something to do with the excess of caution they seem to have displayed in this Ensilage question. Making every allowance for the feeling, perfectly natural, not rashly to experiment with the Society's funds, I still think that they ought not to have allowed the question to be put aside in quite such a cavalier spirit, but should have endeavoured to ascertain the correctness, or otherwise, of what seems to be the general testimony of our brother farmers in the United States.

The more the matter is discussed, even if the object be merely to discover weak points, the greater the good eventually. But I must confess to a feeling of surprise at reading that, when asked by Sir John Maxwell, at the Royal Agricultural Society's half-yearly meeting, in December last, if he had considered the question of ensilage, Dr. Voelcker replied: "The whole question of ensilage appears to me to lie in a nutshell. It is no use discussing the different modes of cooking beef; whether it is most desirable to cook it in the form of beef-steak, steak-puddings, or in any other way. We must first have the material. The question is, what can be grown in England suitable for putting in silos? The most suitable material for the purpose is maize." With all deference to the learned doctor, I must dissent from his dogma; and I do so from an opinion based on actual practice. Granted that we can grow maize, it would not be "the most suitable material for the purpose" in England. A few years ago, at the instance of a Canadian agriculturist, who recommended it as a forage crop, we successfully grew maize on the Merton Home farm. It reached a height of from 5ft. to 6ft., and we calculated its weight at more than ten tons to the acre. You will readily believe that such a crop, although cut in a green state, left its mark upon the land for two or three years, and that in spite of the most liberal treatment. We cut the maize into chaff just when it is said to be most suitable for feeding dairy cows,—when the flowers on the heads were half-develvoped. The cows, though repeatedly tried, were most unwilling to eat it, and what they did eat produced considerable looseness of the bowels, which is believed to have arisen from the indigestible nature of the woody fibre forming the outer rind of the stalks. How far this objectionable feature may be improved by the Ensilage process I cannot, of course, determine; but I have seen several cases reported from America in which horses and mules have suffered a good deal, in a similar way to these cows, from eating maize-ensilage. Further, I must venture to think that we have in this country many grasses that are much better suited to our climate, and admirably calculated to make first-class ensilage. We can grow in many parts heavy crops of sainfoin, lucerne, Italian rye grass, tares, red, alsike, and cow-grass clover, brank or buck-wheat, meadow grass, green oats, and green rye, so that I think, without any difficulty whatever, material enough can be produced to give Dr. Voelcker his "beef steak" and "steak-puddings," with a few "beef-patties" added, and at the same time to supply ourselves and our friends with that grandest of all fare—"the roast beef of old England!"

That very able and talented man, Sir John Bennett Lawes, whom I greatly respect for the good he has been instrumental in doing, is not, I regret to say, judging from his correspondence in *The Times*, to be reckoned among the friends of Ensilage in this country. Sir John holds that the system is not quite of the same importance to farmers in England that it is to their brethren across the English Channel, or on the other side of the Atlantic; and, having received a bulky volume from the United States on the subject, he has published some articles in America recording his unfavourable impressions as a scientist. These are apparently grounded upon a theory: that a serious loss in "the nutritive portion of the plant takes place in the silo." Unfortunately for the theorist, his hypothesis is positively negatived by the results that have attended the application of the principle. The farmers in the United States do not at all share Sir John's belief, and their increased activity in extending the system, and bringing it into general use, has been followed by the most satisfactory results. We see here a remarkable disparity between theory and practice, which requires some explanation. To concur with Sir John Lawes' theory, we must pre-suppose that our Transatlantic cousins have suddenly become fools; and would not such a supposition be the very reverse of what their world-wide reputation for "'cuteness" would lead us to expect! I say it is incredible that we should see this system so generally adopted and extended, with results so uniformly favourable accumulating day by day, if there were any such loss of nutritive properties as Sir John rather hints at than specifically affirms. Take one of several cases recently reported upon. Mr. W. Fowler, in a letter to *The Times*, dated January 15th, 1883, details some experiments by "a man who conducts a large farm in an economic way, and whose books are kept in the right way." He preserved 150 tons of ensilage, which was consumed in April, 1882. To ascertain relative effects he separated 90 two and three-year old steers, as nearly equal in weight and condition as possible, into three lots. He yarded and sheltered lot No. 1 under an open shed, feeding with 20½ lb. chopped hay, and 3 lb. grain daily; lots

Nos. 2 and 3 were kept in a warm stable; the diet of No. 2 consisting of 20½ lb. of chopped hay, a peck of mangolds, and 3 lb. grain, and of No. 3, 80 lb. of ensilage and 3 lb. grain. In about six months' feeding, Nos. 1 and 2 consumed 1¾ tons of hay (£3 10s.), and No. 3, 7 1-5th tons of ensilage (£2 17s.) The gain in weight in the 1st lot was five per cent.; in the 2nd lot, 9 per cent.; in the 3rd (the ensilage fed) lot, 15½ per cent. The gain in the quality of the ensilage-fed animals was also very marked. They sold at 3d. per lb. on the foot at the farm, while the others would not bring 2½d., and were turned out to pasture. "I found," says the maker of the experiments, "the gain in favour of ensilage and on hay to be—a saving in cost of feed of 18½ per cent., a profit in increase of weight of 7½ per cent., a profit in condition of 15 per cent.;—gain, 41 per cent." Here is a margin wide enough to allow for any American "tall-talk," without the substantial character of the advantages claimed for the fodder being in the least affected, and I have no reason to doubt—nay, I thoroughly believe—the assertion of another correspondent, that "the quality of the animals fed on ensilage is greatly improved, by the greatly increased volume which goes into the stomach, and the fine digestive quality of the food."

There is one objection of Sir John Lawes' to which I should like more particularly to refer. He says, "We have a succulent food of the best possible description already, and, if anything, we rather require a dry substance to mix with it than a still larger amount of succulent matter." This doubtless is true, so far as it goes. But you, and the large flockmasters of this country, know how inestimable would be the value of a succulent food for your ewes in February, March, and April, after an unfavourable winter; when your white turnips have been more or less destroyed, and when a backward spring, with cold east winds, besides destroying the tops of any turnips that may be alive, has shrivelled up, as it were, every bite of grass on your new layers. What would you not give then for some succulent, milk-producing, food for your ewes! You know perfectly well, at such a time as that, you are at your wits' ends what to do. You may give corn, you may give cake, but it will not help your ewes to the extent required to produce milk for the lambs. If, then, ensilage were brought into such a state of excellence as to form a succulent, highly-nutritious, and milk producing food, available in abundance at such times as this, would it not be welcomed as a great boon and blessing, especially as sheep are becoming every day more and more scarce and dear? This suggests to me that a great deal more food might be raised on light-land farms, suitable for a flock of ewes, than is now produced. Where the land is clean, and in good condition, by the application of a mixture of Peruvian guano, bone dust, and rape cake, at a cost of from 30s. to 35s. per acre, and by ploughing the land, and sowing four or five bushels of rye per acre, as early as possible after harvest, the chances are that a good crop of green rye would be produced in ordinary seasons by the end of the following June or early in July. It could then be cut and converted into ensilage for the use of breeding ewes early the following spring; while after the land was cleared there would be time sufficient to grow, the same year, a crop of common turnips, which would be also available for the flock.

THE MERTON TRIALS AND RESULTS.

LORD WALSINGHAM'S FAITH IN ENSILAGE.

We now come to a branch of our subject which, from its more personal character, and the exhaustive tests it furnishes, will probably be of the greatest interest to you, and will claim your special attention. After what has been advanced heretofore, it will, perhaps, surprise you to be told that in this matter my position is somewhat analogous to that of a penitent. Whether through a "natural sluggishness," which is so often ascribed indiscriminately to all associated with the cultivation of the soil, or from a habit of caution, the outgrowth of years of experience, —in the course of which so many fair promises to Agriculture have bloomed, only soon to fade and die,—I will not attempt to determine; but it certainly was with doubt and misgiving that I first heard sung the praises of this new expedient, and was assured that it might be introduced with advantage into English farming. Do I make this admission to my shame? Let me say, "If my original doubting argues a want of faith, is not my now firmly-rooted, well-matured, belief entitled to so much the greater respect?" With a sagacious foresight, which I should have more promptly and readily recognised, Lord Walsingham, upwards of two years ago, expressed his confidence that this new method of preserving our green forage crops was both sound in theory and practicable. He desired that it should be fully investigated, and believed, if a series of trials were entered upon with skill and care, results might be reached that would be of great service to the agriculturist, pointing out to him one way at least of being less at the mercy of such crippling seasons as those experienced in the last seven or eight years. The thing, however, presented itself to me as one of those charming "fads" which many good-intentioned landowners take up in singleness of heart; seldom with other result than the expenditure of large sums of money, which is worse than useless, because it only further disappoints, disheartens, and discourages them. But Lord Walsingham was not to be influenced against his own judgment, or turned away from the purpose which he contemplated, by any argument that I could advance. Appreciating keenly the strange and startling vicissitudes through which British Agriculture has passed in these later years,—feeling how unreasonable it would be to expect poor heart-sick, half-ruined, farmers to incur the risk of "fancy experiments" on their own account,—his Lordship, whose hand readily responds to any generous impulse, embarked upon a venture which no one rejoices more than myself has been, so contrary to my expectations, a grand success. Lord Walsingham was early encouraged in his undertaking by the thoughtful perusal of a pamphlet and many letters, giving much valuable information on the Practice of Ensilage in America, furnished him, through his friend, Mr. Augustus Tollemache, by Mr. C. A. Henderson, Her Majesty's Consul at Boston, Massachusetts. Meanwhile, in proceeding to give effect to his lordship's wishes and commands, I sought balm for my doubting spirit in the crucial severity of the tests which I prepared, and which tests have driven conviction home to my mind. Having thus delivered my conscience, and indicated that for any good which may accrue from these Merton experiments the credit is due solely to Lord Walsingham, I will detail to you the trials we have made, with their results, as diligently observed, and faithfully recorded, by us.

OUR FIRST SILO.

In the month of July, 1881, we had a small silo constructed on the ground floor of a granary. Its internal measurements were—8 ft. 4 in. long; 4 ft. wide; 4 ft. 4 in. deep. The walls were made of 9-inch brick-work, coated with cement plaster, about half-an-inch in thickness. In August the silo was filled with grass chaff, and we made our first experiment, which was a sharp and trying one. I had read that chaff made from grass in a damp state could be put into silos with the certainty of its conversion into good ensilage. The truth of this assertion I decidedly tested. The chaff with which I experimented was made in equal parts from second crop red clover, and rank-grown succulent grass, cut from a pasture which had been heavily-folded with cake-fed sheep. The grass and clover were both cut and carted in a drizzling rain. The chaff when made was at once put into the silo. It was salted at the rate of 1lb. of common field salt to 1 cwt. of grass chaff, and was trodden down as firmly as possible. A layer of salt, in thickness about an inch, was thrown over the mass. Above this were laid two wood shutters, covered over with 9 inches of bran. Pressure was got with large stones, weighing together about three-quarters of a ton, regard being had to an equal distribution of weight.

The introduction of bran demands a word or two of explanation. I chose this covering in order to exclude the air by a cleaner and also a more effectual mantle than soil. As shrinkage goes on, soil has a tendency to crack and gape, making openings which not only admit air, but cause some portion at least of the soil to work its way down into the ensilage, and, if not spoil, damage it to some extent. Now, the superiority of this bran covering is obvious. The subsidence of the fodder is not attended with any cracking of the surface layer; the bran running down and filling up crevices as they occur, and so effectually excluding the air. Moreover, there is the immense advantage of perfect cleanliness combined with subsequent usefulness. Not only is the ensilage saved any injury whatsoever, but if the bran be given to stock, they will eat it almost as readily as they do any brought direct from the merchant's granary; so, of course, any little quantity that gets down into the ensilage does no sort of harm. I have a pleasant bit of independent testimony to give as to this. General Marshall, of Broadwater, Godalming, visited our silo, on January 17th last. He was greatly impressed with our method, which he saw in actual operation, and expressed his conviction that bran is the best of all protective coverings, not only from the way in which it evidently excludes the air, but also from the prevention of any injury to the fodder in removing the cover.

After the lapse of about three months, we opened our little silo. We found some of the contents to be useless. The upper portions of the ensilage, to the extent of a third of a foot, were in a state of decomposition, and unfit for feeding purposes. Decomposition was also going on at the bottom of the silo. Its depth was some four or five inches. But beyond these upper and lower layers the chaff, although it was so wet that water could be squeezed out of it easily, was quite green and fresh, with a strong aromatic and acid-like smell. At the outset the cows offered the food did not take kindly to it; but in the course of two or three days they began to manifest a fondness for it, and afterwards ate it freely. The herdsman gave it in the first instance to only half the cows in the house. In feeding these he passed in front of the other cows to whom none was given, and it is a noteworthy circumstance that in the course of a week or so the appetite of these animals, familiarised with the aroma of the ensilage, as it was carried by them, became evidently excited, for, in the man's own words, they "made a grab at it." He was thus induced to give them a little of the food also. They liked it much; their manner indicating that they would have been glad of more. I forwarded a specimen of this ensilage to Arthur J. Scott, Esq., of Rotherfield Park, Alton, who has written me several interesting letters as to his own experiments, which have been uniformly successful, even in one instance where they were conducted under certain drawbacks and disadvantages. Of the good-feeding qualities of our ensilage he spoke approvingly. He said, "My cows eat it well; yet it had been kept in a box over a week, which I daresay did not improve it." In 1881 this gentleman pitted some vetches, which made admirable food, and last year his ensilage consisted of clover and rye grass. The silo was opened a few days before Christmas, and of this ensilage he wrote me as follows:—"I have just opened my pit of clover and rye grass, and IT IS ALL RIGHT, AND THE CATTLE EAT IT GREEDILY. The pit is unlined, so a little of the outside is spoilt by damp from the earth, but *even that the cows eat when tossed into the yard.*"

Though the result of the trial was by no means unsatisfactory, our success at Merton was only partial. It, however, was enough to lead me to waver in my disbelief. Other experiments, on a much larger scale and a somewhat different plan, were arranged. We naturally determined to profit by the lessons of our first trial. These were that it is not advisable to cut and cart grass for ensilage in so wet a state as we had done our's; and, further, that we should not overlay the whole lot with salt. We carefully avoided doing either in our fresh trials, and I am sure you will think we were right when you hear of our subsequent experience.

SILO CONSTRUCTION IN ENGLAND.

Before advancing any further, let me refer generally to the principle of Silo construction in England; a question of prime moment, because a false step here may entail such an outlay as to put the balance in a profit and loss account altogether on the wrong side. As previously described, silos in America and France are usually constructed below the surface. Let me at once demur to the proposal to bring this kind of solo into general use in England, There are both practical and economical reasons against attempting it. It is a fundamental necessity in ensilaging that the silo, or receptacle, be air and water-tight. And, I would ask you, as practical men, how many places are there in this county where pits could be sunk 14 or 15 feet that would not be more or less affected by water in the soil? What would be the cost of excavating and carting away the soil from a large pit, and what the difficulty and expense in many cases of getting rid of the water, while the work of excavating and of building was going on? Then, when the silo was built, would you have any guarantee that your brick and cement-plastered walls would be water-tight? Again, there would be the cost of making and draining a road down to the silo, and who will estimate that? To provide such structures would be, in my judgment, a fearfully laborious and expensive, if not an impossible task. We are told that a silo ought to be well-drained. With that I thoroughly concur. Here then would arise another, and all but insuperable, difficulty so far as many parts of this country are concerned. What would be the cost of draining a silo 14 feet deep on some of our flat and low-lying lands? If capable of being drained at all, the drain would have to be carried a distance of a mile or more, and be laid at a depth that would involve an enormous money expenditure before we should get rid of the water. Take as an illustrative case the Merton Home Farm. Some years ago we built a chaff-house, in a convenient situation for the machinery to be worked by a fixed steam engine, and we sunk it five feet. The lower floor is frequently flooded to a depth of from nine to twelve inches. Within the last few weeks it was covered with four inches of water. To drain this room, as it is, we should have to go a distance of at least half-a-mile. But if the floor were lowered to 15 feet, as it must be for an underground silo, we should have to carry the drain three times this distance (or a mile and a half) before we discharged the water. On some of the flat lands in Norfolk, Cambridgeshire, Lincolnshire, and elsewhere, the state of things would be even worse. It would be quite out of the question to drain such pits at all. Therefore, I say, do not attempt the sinking of silos, but construct them above-ground. And here the question naturally suggests itself, whether we do not already possess buildings which, by a very simple and inexpensive adaptation, would answer every purpose; for, in these days of steam-threshing, all our barns are no longer required, as they were when corn was knocked out of the straw by a long stick with a joint in it, called by our forefathers a *flail*. Of course, the construction of the silo in a hill-side diminishes the force of this objection, and there may even be some advantages in that plan; but you know it is not every one who has got a hill on his farm, unless it be a "mole hill" (of which in some districts there are many); and in such a matter as this we want our views to broaden-out rather than to narrow-in. The silo that is to come generally into vogue should be simple, and *must not be costly.*

BARN-SILOS.

Realizing the difficulties of which I have spoken, we determined to convert one bay of a clay-built barn, at Merton, into silos. This is how we did it. Across the bay-front we put up a 14-in. brick wall to within 3ft. 10in. of the tie-beam, and two division walls of the same description, which gave us three silos, each 14ft. 4in. in length, 6ft. 3in. in width, and 9ft. 3in. in depth; the cubic space being sufficient for at least fourteen or fifteen tons of ensilage; but there is no reason why two feet more brickwork should not be added to the height of the walls, so as to make room for three tons additional, or seventeen or eighteen tons in each silo. The barn-floor was laid with asphalte some years ago, and therefore the silos required no new bottom. We covered the walls with cement plaster, composed of Portland cement and well-washed road silt, in the proportions of three of cement to one of silt. This coating, which was about half-an-inch in thickness, answered well in every respect, and shewed, I think, that even clay-built barns are easily convertible into good silos. I ought to state that to prevent the brick-work being displaced in the filling process, a 2½-inch plank, 14 inches wide, was properly secured to the wall-tops, and to facilitate the emptying of the silos a well-made 1½-inch boarded door, protected by a coating of hot tar and pitch, was inserted in one corner of the front wall of each silo. The frames of the doors were set on the inside, so that the doors opened inwards to the partition walls, and the apertures were hermetically-sealed by means of 4-inch brick work on the front sides. The total cost of these three silos (Plan A) did not exceed £30.

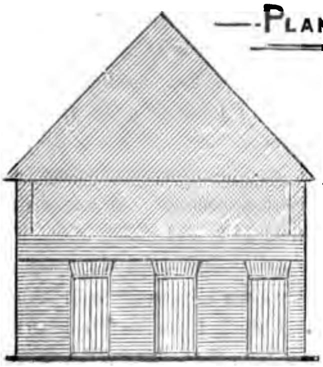
BARN-SILO EXPERIMENTS.

As I have already intimated, it was my serious intention that the experiments we made should not err on the side of lenity. With this object, I used coarse common grass for the test. (Referred to in the analysis as No. 1.) Two of the silos I directed to be filled with grass taken from an oak wood, known as Merton Wood. Forty years ago this piece of land was thickly covered with large timber oaks and a dense mass of underwood. The trees were thinned out, and the underwood grubbed, to make a view from the Hall. No grass seeds were sown then or afterwards, but the grass grows there from "Nature's own seeding." For some years I was in the habit of giving the grass to respectable persons who were disposed to cut it for litter. During the past few years none have cared to have it. They have said, "It is such poor stuff, if it once gets wet after being cut there is little chance of getting it dry again; it is then useless even as litter." You may, therefore, conclude that if the Ensilage principle, when applied to grass of this coarse and common character, has been successful, much greater things would be gained from the finer and better sort of grasses. The ensilage in the third silo, I may add, was from grass grown in a rough meadow. (Referred to in the Analysis as No. 2.)

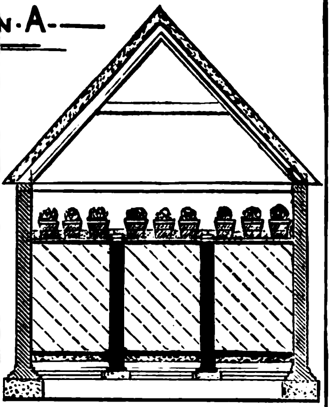
The silos were filled uninterruptedly, in the course of three or four days, early last July. Although the weather was dull and sunless, there was no rain. The grass was loaded on to waggons as

.AN OLD CLAY-BUILT BARN.
CONVERTED INTO SILOS FOR ENSILAGE —

—.PLAN.A.—

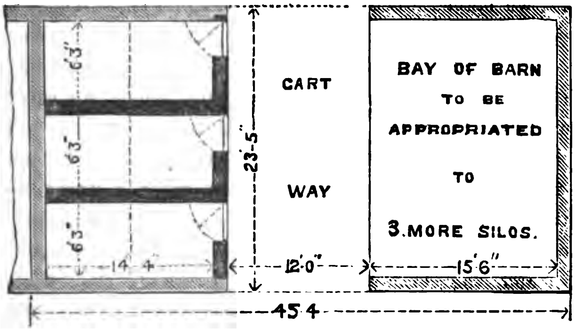


— ELEVATION —



— SECTION. —

SCALE OF 10 5 0 10 20 30 FEET.



— GROUND · PLAN —

OLDHAM-CHAMBERS AND WILLINS. M.R.I.B.A.
.ARCHITECTS. AND SURVEYORS.
.BANK PLAIN . NORWICH.

it was cut, and conveyed direct to the chaff cutter, which stood on a floor about five feet from the ground level; the chaff usually falling from the cutter into large sacks suspended beneath the cutter, and these as they were filled were removed and replaced by empties; the full sacks being loaded on to a van standing close at hand. This work, as indeed the whole process, was expeditiously done. On the van being drawn up alongside the silos, the sacks were hoisted over the front wall into the interior of the magazine, where three men were engaged in emptying them, and in spreading, treading, and ramming down the chaff with wood rammers. Amongst each cwt. of chaff two lb. of common field salt was distributed. Let me here say, once for all, that a great deal depends upon the treading and ramming process. The more effectually this is done the better will be the ensilage; and shall I be forgiven, in this age of "Blue Ribbonism," if I mention that the application of a little good honest malt and hop beer—*not* to the ensilage but to the men—had in my case a marked effect in getting the work done with a right, hearty good-will.

When the silos were quite filled, the contents having been as well-trodden and rammed down as possible, they were covered with wood shutters, over which, as in the former experiment, we spread a bed of coarse bran, about eight inches deep. For weights we used a lot of clean flint stones, in wicker skeps, which cost a shilling a-piece and will last for years before requiring to be renewed. The pressure, which we carefully distributed over the whole surface, was little more than a ton-and-a-half in each silo, which contained, as I have before stated, about fourteen or fifteen tons of cut grass. Three weeks after the filling of the silos, the ensilage had shrunk by about one-third of the original depth. We then removed the weights and the bran-covering, again filled the silos to the top, and replaced the boards, bran, and skep-weights. Little labour and no difficulty attended this operation. The skeps were lifted on to the partition walls, and the bran was put temporarily into sacks. An accurate and detailed account of all the expenses attending the filling was kept by the Farm Bailiff. The amount did not exceed 12s. 9d. per acre, and had the crop been made into hay it would have averaged about one-and-a-half tons to the acre. There was but slight heat; no mouldiness was visible when the shutters were removed to refill the silos; and it is also a fact worthy of notice that in the ensilage now used from them there is nothing to indicate where the later filling began. With regard to the cost of making ensilage of grass, as compared with that for the same weight of hay, we had no actual data to guide us to a definite conclusion. But I was desirous of getting some reliable, practical estimate, and, through the kindness of W. Biddell, Esq., M.P., of Lavenham-hall, Suffolk, and Mr. T. Gayford, of Wretham, Norfolk, gentlemen of great experience and ability as valuers, I have received particulars which enable me to state that in an average season the cost of making one-and-a-half tons of grass into hay, stacking, and afterwards cutting into chaff, is from 25s. to 26s. per acre. From this it will be seen that our ensilage was produced at a saving of 50 per cent. on the cost of ordinary hay-making and chaff-cutting.

Five months elapsed (Dec. 11th) before we opened No. 1 silo. On removing the covering, the thermometer registered 61 degrees. This temperature obtained to a depth of about two feet, when there was a considerable fall; still lower down it was quite cold. We fetched the ensilage over the top, until we had cut down a section sufficiently large to admit of the sealed door being opened; after which we carried it out through the doorway in the usual manner.

Now, as to the quality of the ensilage. As you have seen, the grass we packed was very inferior to that put into the small Trial Silo in 1881-82. Yet there was such a marked superiority in the quality as to strike all of us with surprise. This improvement I attribute to three causes; viz.:—the grass not having been cut or carted in a wet state; 2lbs. of salt instead of 1lb. having been used to each cwt. of grass; a layer of salt at the top having been dispensed with. This year the ensilage is nicely moist; but no water can be squeezed from it, and it is quite free from mould. When first given them, the horses, cows, and young stock ate it readily, and have since continued to do so. The horses, to which we give one-third ensilage to two-thirds chaff, are doing remarkably well. This is especially true of one horse, a notorious bad feeder, very squeamish as to its food. The team-man tried it with ensilage mixed with straw chaff, and now the "bad-doing brute," as the man described it, when attention was called some time since to its low condition, feeds well, and is visibly improving. It should be understood, by the way, that the horses have the same allowance of corn now that they had before mixing ensilage with their chaff; but there is not one on the farm fed with it that does not eat it with relish. An old and experienced teamman, who said he had no objection to try the food if desired, but thought it would do no good, as it was made of such "rubbishy stuff," has come to believe in the "rubbishy stuff;" to which some remarkable properties are also ascribed. For several years an aged horse had suffered in the winter season, when eating dry food, from stiffness in the fore-quarters. Last year the stiffness laid it by for a month. This winter it has been sound and well. Two or three other horses when eating barley straw chaff in the winter have also been afflicted a good deal with grease in their heels. This year there has been little, if any, complaint of the kind. These comforting immunities the bailiff attributed entirely to the ensilage food. You, taking his belief for what it is worth, will form your own conclusion.

OVERGROUND SILOS—PLANS & SPECIFICATION.

As I have insisted upon the desirability of silos being constructed above ground, and as there will be many cases in which barns cannot be utilized, I may be expected to give some idea of the kind of building I would in such cases provide. This is the more necessary from the line taken by two or three newspaper Correspondents on the subject, and the alarming character of some of their estimates. One of these, Mr. Wm. A. Gibbs, of Gillwell Park, Essex, in a letter to *The Times*, dated Jan. 10th, 1883, gives what he calls "rough facts and figures," as to the probable average cost of constructing silos in England and America. The method of reckoning adopted by this gentleman is novel and somewhat amusing. What would any business man think of a manufacturer's calculating the cost of the goods he manufactured in any given year by adding to the expenditure on account of material and labour *the gross outlay originally incurred in buildings, plant, and machinery?* Yet this is precisely what Mr. Gibbs has done. A silo is built at a cost of about £50; in it are stored eight tons of dry trifolium, the produce of three acres; *ergo*, he says, "dividing £50 by 3 would give £16 6s. per acre as the requisite outlay for storing this especial crop." Even farmers know something about "capitalized charges," and can see at a glance how altogether fallacious such an argument is. But, I renew my contention, that if ensilaging is to be practised in England, the erection of silos must not involve anything like so great an outlay as they have done in certain places. To lessen the expense, as they suppose, some persons strongly favour building large silos. Now, I do not myself agree with them. For the storage of 100 tons of ensilage I would recommend four moderate-sized silos, all, however, under one roof; and not one huge structure. Several reasons may be given for this recommendation. In a 25-ton silo, the spreading, treading, and ramming can be much more effectively performed, the pressure more equally distributed, and the filling more rapidly accomplished, than in a 100-ton silo. When emptying, too, from a much less surface being exposed, and the reduced time over which the process extends, the ensilage is less likely to get out of condition. Of course it may be objected that additional expense attends the division of one large silo into four. Nay; as the extra building is confined to the cross walls, need the expense be at all extravagant? Against the cost of this extra walling you are able to set, as I have pointed out, the advantages of greater dexterity in filling and emptying the silos, the better preservation of the fodder, and the consequently improved quality and value of the ensilage. An enormous sunk silo, like Viscount Chezelle's, with the ensilage levelled by the tread of horses and bullocks, undoubtedly possesses advantages and conveniences of its own; but in that case the expense of top-covering and weighting the ensilage must be proportionately increased. The plan which I would recommend for adoption is the plan marked B.

By this plan, which is drawn 16ft. to the inch, we get four silos, each of the following dimensions:—Length, 17ft. 6in.; width, 9ft.; depth, 10ft. The cost is by no means considerable, as you will see from the following carefully-prepared Specification and Estimate :—

PLANS B.

A General Specification of Works required to be done in the erection of Four Silos under one roof, as shewn by plans marked B, prepared by Messrs. Oldham Chambers and Willins, M.R.I.B.A., Architects, Bank Plain, Norwich.

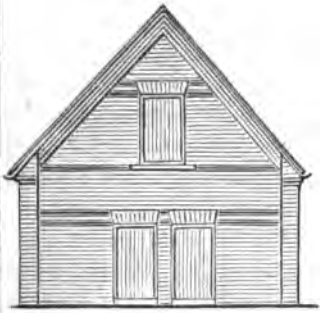
January, 1883.

Excavate for trenches for foundations to walls of the depths and widths shewn on drawings, and fill in with good concrete composed of five parts of broken bricks or small stones, one part of sand, and one part of good chalk lime, to be thoroughly mixed with water and thrown in, and to be well rammed and made firm. The walls to be 14in. with proper footings, and to be of good, sound, hard kiln-burnt bricks, and bedded in mortar, composed of well-burnt fresh-slaked lime and clean sharp pit sand, in proportion of 2½ sand to 1 of lime, properly mixed with mortar—no four courses of brickwork to exceed 12 in height. The floors to be of concrete, 4 thick, and covered with ¾ cement plaster, composed of equal proportions of best Portland cement and well washed road silt. The walls throughout ground level to have a double course of slates (well lapped) in cement. The walls inside to be rendered and floated half-an-inch thick with plaster, with equal proportions of best Portland cement and well washed road silt. The roof to be constructed of sound foreign deals with principals, &c., of proper dimensions and 4 iron tie rods 1in. in diameter at the level of the wall plate, properly bolted; and all other woodwork to be done in foreign deals. Cover the roof with hard, well-burnt, sound pantiles, on reeds, well lapped and secured and bedded in mortar. To provide 3in. pitch pine planks for covering the top of inside walls, and properly secure them with iron holdfasts; provide and fix 1½ framed and braced doors hung to proper rebated door frames. These doors to be fixed to silos and gables; to provide and fix oak sills to these doors, and the frames to be securely mortised into same. To provide and fix 4 O G cast iron water gutters on both sides of the roof, and to properly connect with the necessary 3 inch down pipes, and to have four cistern heads, proper drainage being provided to carry the water away from

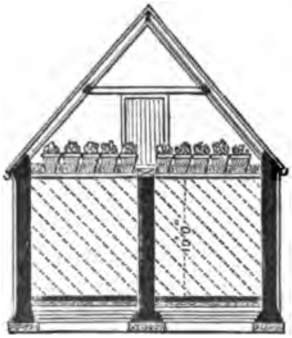
·PLAN OF FOUR SILOS UNDER ONE ROOF·

—·CALCULATED TO HOLD ABOUT 100 TONS OF ENSILAGE·—

—·PLAN. B·—

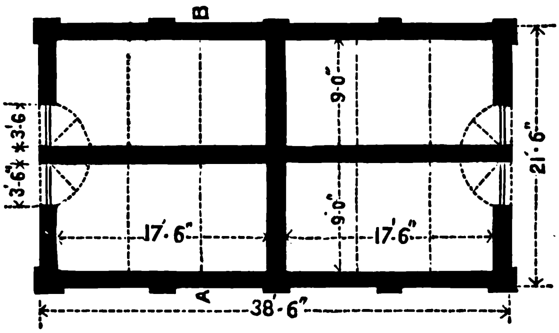


—·ELEVATION·—



— SECTION. A.B —

SCALE OF 10 5 0 10 20 30 FEET.



—·GROUND. PLAN·—

·OLDHAM-CHAMBERS AND WILLINS·M·R·I·B·A·
·ARCHITECTS AND SURVEYORS·
·BANK PLAIN·NORWICH.

the buildings. The outside wood work and iron work to have three coats of good oil and white lead paint, made to approved colour. Clear away all rubbish at completion of works.

ESTIMATE.—The whole of the above-named work to be done in a sound and workmanlike manner, and to the satisfaction of the Architects, for the sum of £175, exclusive of carting.

It is, of course, possible that a tenant may not be disposed to invest in such a permanent improvement, except on the understanding that he is to be allowed for it, by valuation, at the end of his tenancy. But I would suggest the desirability of landlords assisting their tenants in building silos; the former finding the money, and charging 5 per cent. for the outlay, and the latter agreeing to do the carting free of cost. By this arrangement the tenant would obtain a silo at the moderate yearly charge of 1s. 9d. per ton on his ensilage. If by any chance the system were to fail, the division walls might be taken down and the building turned into a covered yard for fattening bullocks. Should it be urged that, even under these circumstances, such are the consequences of prolonged depression, some landlords, however anxious to help their tenants, will not be able, without inconvenience, to advance the requisite capital for such a purpose, I still think the difficulty might be overcome in the interest of both parties. The Lands Improvement Company, if applied to, would doubtless find the money at £6 12s. 4d. per cent., and if the tenant were ready to pay his five per cent., no landlord, I should think, would be either unable or unwilling to pay the remaining £1 12s. 4d. per cent., especially as the buildings would become his absolute property at the end of twenty-five years.

LONG GRASS ENSILAGE.

The subject of Long-grass Ensilage demands to be noticed, before I enter into any scientific evidence as to the value of our Merton chaff ensilage. I just now alluded to the experiments of

Mr. Scott, in Hampshire. That gentleman's last year's test bears very important testimony indeed as to the general value of ensilage. Owing to his men being busily employed in other ways, the clover and rye grass, of which he speaks so highly, was pitted just as it was cut. Successful as he appears to have been, there is, of course, much greater risk attending the ensilaging where the grass is uncut into chaff, because, when long, the grass can not be so easily compacted, nor the air so effectually excluded. I may also observe, in this connexion, that experiments have heen conducted with long grass by Lord Wharncliffe and another gentleman in Yorkshire. His lordship's tests have been successful beyond the most sanguine expectations, as I can testify from a sample forwarded to me a few days ago. The other gentleman also reports a success. In the early part of last summer he constructed a simple oblong silo, twelve feet in length, seven feet wide, and eight feet deep. A quantity of coarse, roadside grass was first deposited in the silo ; next a layer of stalky grass ; and then coarse aftermath. The grass was cut at separate periods, extending over a fortnight, in the latter part of August, and the middle of September, by two men with scythes; it was loaded by a man who followed with a horse and cart, and conveyed direct to the silo, where it was well shaken out, so as to equalize its density. Part of the grass was in a dry, and part—the aftermath—in a wet state. A couple of days elapsed between each deposit, to allow for shrinkage, which ultimately went on to about one-half the original bulk. On the 14th of September, the silo was finally sealed, and it was intended to have left it undisturbed until Christmas. On the 25th of November, however, the gentleman yielded to the importunity of a visitor, who was impatient to learn "the result." What that was is related by Mr. Thomas Easdale, of the Pepper Hall Estate Office, East Cowton, Northallerton. He says, [communicated in a letter to *The Field*,] the result was, "even to those who were believers throughout, a most agreeable surprise. The whole mass of ensilage was found to be in a perfect state of preservation, and it gave forth a most pleasant aroma, not easily described." At first the cattle were somewhat reluctant to eat it, but on the second day they took it eagerly, and by the end of the first week they ate it "ravenously;" as if it were the best oil cake.

Though I am very glad indeed to note that Ensilage has thus been made from long grass, and have no desire to speak disparagingly on the point, I must say that I prefer to regard it as an open question. No doubt, the gentlemen who made these experiments exercised considerable care in seeing that the grass was well-shaken, and distributed thinly and judiciously throughout the silo, as had it been deposited in lumps, without such shaking, my own experience leads me to believe that it would have been likely to overheat, rot, or become mouldy. Let me illustrate this. On one of Lord Walsingham's off-farms the bailiff constructed two small silos, locating them underground, where the soil was dry, as he was directed to do. One silo was filled with green brank stalks or buck-wheat, when partly in flower and partly in seed. The stalks were cut into chaff, and the bailiff, rather misunderstanding his orders, mixed at least three lbs. of salt to the cwt. In the other silo, side by side with it, was also deposited green buck-wheat, not cut into chaff, but salted at the same rate as the other, and carefully trodden down. The two silos were weighted and hermetically-sealed with soil. When they were opened, four months afterwards, the brank that had been cut into chaff was as green, and apparently as fresh, as when first pitted, even some of the white pinkey flowers retaining their colour. It formed a really appetizing food for horses and cattle. But the long brank was in an unsatisfactory condition, and useless for food; the old foreman on the farm remarking, that "it looked like muck, and smelt like muck." Apart from this, I do not think that long grass ensilage would be found very useful in Norfolk, and other counties where a good deal of straw is cut into chaff for the use of stock. In fact, it seems to me that one great advantage of ensilage is the possibility of mixing it with straw chaff, and thus make the chaff not only more palatable but also more digestible. Ensilage of long grass would not readily mix with chaff, and I do not imagine the Ensilage could very well be cut into chaff after it was taken from the silo. I, therefore, say that while it may be useful in hilly districts, where no corn is grown, and where, therefore, there is no corn-straw to be used as food, its service here is doubtful, even if the process itself did not fail. As I have said, without condemning the practice, which I have not sufficient authority for doing, I prefer myself to have the grass cut into chaff before ensilaging. It is certainly much more closely packed in that form, and is also better adapted for feeding purposes.

VALUE OF ENSILAGE FOR DAIRY COWS.

In the early part of last year, when we gave ensilage to our cows, the Dairymaid was so forcibly struck by the improvement in the *colour* of the butter, that early in November she asked me to allow one of the silos to be opened, in order that the cows might be fed with some of the ensilage food, so as to be sure of butter of superior quality and colour during an expected visit of their Royal Highnesses the Prince and Princess of Wales to Lord and Lady Walsingham. In case of any failure, however, I hesitated to grant the request, and finally decided that no ensilage should be introduced into the dairy until after the Royal Visitors' stay had terminated. But, in order to ascertain the effect of the ensilage on the cows, Lord Walsingham suggested, shortly before opening the silos, that the milk and cream, before and after the ensilage-feeding, should be carefully tested, and the results tabulated. For this purpose I selected five pedigree shorthorn cows, which dropped calves 27th July, 27th October, 24th November, and (2) 30th November, 1882. Previous to giving ensilage, each cow was daily fed with 6lbs. of crushed oats and 3lbs. of bran, mixed with chaff (composed, two-thirds of barley straw and one-third hay). The five animals yielded, on the 10th of December, 68 quarts of milk, which the lactometer shewed contained 12° of cream. We commenced feeding with ensilage on the 11th of December, and the following tables give the daily diet and yield from December 14th to January 10th :—

MILK AND CREAM TEST, WITH DAILY DIET AND YIELD.

(*From Dec.* 14, 1882, *to Jan.* 10, 1883.)

⅓ Ensilage, ⅔ Chaff with Oats and Bran as before.		
Date.	Quarts of Milk per day.	Degrees of Cream as per Lactometer.
1882.		
Dec. 14	70	13
„ 15	70	13
„ 16	70	13
„ 17	70	13
„ 18	70	13
„ 19	70	13
„ 20	70	13

½ Ensilage, ½ Chaff with Oats and Bran as before.		
Date.	Quarts of Milk per day.	Degrees of Cream as per Lactometer.
1882.		
Dec. 21	71	14
„ 22	70	14
„ 23	70	14
„ 24	71	14
„ 25	70	14
„ 26	70	14
„ 27	71	15

⅔ Ensilage, ⅓ Chaff with Oats and Bran as before.		
Date.	Quarts of Milk per day.	Degrees of Cream as per Lactometer.
1882.		
Dec. 28	72	15
„ 29	72	15
„ 30	74	15
„ 31	74	15
1883.		
Jan. 1	76	16
„ 2	76	16
„ 3	77	16

¾ Ensilage, ¼ Chaff with Oats and Bran as before.		
Date.	Quarts of Milk per day.	Degrees of Cream as per Lactometer.
1883.		
Jan. 4	78	16
„ 5	80	16
„ 6	80	16
„ 7	81	16
„ 8	82	16
„ 9	82	16
„ 10	82	16

It will be observed that on the 14th December, three days after the ensilage feeding commenced, the milk had increased by two quarts and indicated a rise of 1° in the quality of the cream.

This went on until the 20th. On the 21st the cows gave 71 quarts, with 14° of cream; the latter shewing a further advance of 1°. On the 22nd and 23rd, and the 25th and 26th, they seem to have fallen back to the extent of a quart per day, which was probably owing to the cold, wet weather which we experienced at that time; but the lost quart was recovered on the 27th, when the supply again reached 71 quarts and the cream reached 15°. The quantity rose on the 28th another quart (72 quarts) and on the 30th and 31st 74 quarts were registered, with the improvement in the cream fully sustained. New Year's day brought 76 quarts and 16° of cream; on 4th Jan. another quart was gained; on the 5th and 6th, 80 quarts were given; on the 7th, the return rose to 81 quarts; and on the 8th to 82. The figures remained stationary until January 10th, when the test ended. You will, therefore, see that when the month's trial concluded the milk return was increased by 14 quarts per day, and the quality of the cream had undergone the remarkable advance of 4°. You will further observe from a study of the tables that the increased quantity of the milk, and improved quality of the cream, corresponded with an enlarged supply of ensilage to the cows.

Before I turn from this branch of my subject, let me state that Lord Walsingham's trials have already borne fruit. His Lordship's example is to be followed by a fine old English gentleman who combines with a sound practical business mind a kind-hearted disposition that makes him a model landlord. Lord Tollemache, of Helmingham, last week travelled all the way from his estate in Cheshire to inspect the Merton Silos and their contents. He is specially interested in Dairy farming, and, being satisfied as to the utility of the system, he has determined at once to construct four overground Silos, under one roof, on the Merton plan, each to hold from 25 to 30 tons of ensilage.

On Saturday evening his Lordship wrote as follows:—"After seeing the Silos and Ensilage at Merton, I am more than ever satisfied of the importance of introducing that system, especially in a Dairy county like this. Many thanks for the box of Ensilage you kindly put up for me, which I intend to open for some leading tenants to see and examine the contents."

A TRIAL WITH EWES.

Ensilage having proved thus valuable as a food for dairy stock, it would be only reasonable to suppose that sheep may be advantageously fed upon it. Still, experimental knowledge is demanded in this as in other cases. I am, therefore, glad to report that so experienced and well-known a flockmaster as Mr. Thomas Gayford, of East Wretham, Thetford, kindly undertook to feed a small number of his sheep on ensilage, which I supplied to him twice a week. Of 60 ewes, separated from the flock to forward their condition for lambing, he ran out ten for trial. On the first day he served out to them, with other food, a peck of ensilage. They were evidently shy about taking it; still they cleared it out before night. The next day the same quantity was given, and eaten with less hesitation. On the third day the allowance was raised to two pecks, and it was consumed without the least squeamishness. At the end of a week the daily ration was made three pecks. Then and since they have evidently relished the food, *preferring it to fresh, sound turnips*, and, as far as can be judged, it agrees with them admirably. At all events, they have gained in condition, their coats have visibly improved in appearance, and they continue to do well all round. The shepherd reports most favourably of the food, which I regard as especially encouraging testimony, because my knowledge of the shepherd class leads me to regard them as a very careful, cautious set of men, who are exceedingly slow in forming opinions of new methods, and rather disposed to look with disfavour, than otherwise, on any departure from the orthodox routine of feeding a flock. It is, of course, too early to tell what influence the ensilage will have upon the milk of the ewes. That can only be determined after lambing; but, by parity of reasoning, it ought not to fall behind what we experienced in the case of our pedigree cows. It is also to be particularly remarked, that as sheep eat the food thus readily in such a mild, open season as the present, they would certainly do so during a severe winter, and in a cold, protracted, late spring,—the time of all others when flockmasters most require a succulent, palatable, food for their ewes.

MILK ANALYSIS.

We were naturally anxious to test the quality of our Ensilage milk by analysis, and on the 9th January we sent two samples to Mr. Francis Sutton, F.C.S., of Norwich, who, besides holding the position of County Analyst, is Analyst to the Norfolk Chamber of Agriculture, and whose high attainments are so widely known that I need not say another word as to his qualifications. No. 1 sample was the milk of cows not ensilage-fed; No. 2 came from the five cows, the subjects of the test. The following is Mr. Sutton's report:—

CERTIFICATE OF ANALYSIS.

County Analyst's Office and Laboratory,
London Street, Norwich, January 10th, 1883.

	Per cent. No. 1.	Per cent. No. 2.
Pure Fat	2·76	3·11
Sugar Casein, Albumen, &c.	9·37	9·82
Water	87·87	87·07
	100·00	100·00
Mineral matters (ash)	0·70	0·75
Specific gravity at 60°	10·30	10·32

(Signed,) FRANCIS SUTTON.

This analysis, you will observe, is in favour of the No. 2 (Ensilage) milk in every respect. Whilst in Pure Fat there was an increase of 0·35, and in Sugar, Casein, Albumen, &c., of ·45 there was a decrease of ·80 water. Mr. Sutton also wrote to me as follows :—

"From my examination of the Ensilage, so far as it has now gone, I should be quite prepared to believe in its value as a milk-producing food owing to the great proportion of soluble nutrition in it.

"*These results have fairly surprised me, and when you get them I feel sure they will have the same effect upon yourself.*"

It is a striking fact, not to be passed over, that two cows which had been fed with ensilage, on being deprived of the food for a couple of days, gave three quarts of milk less each day.

ANALYSES OF THE ENSILAGE—IMPORTANT RESULTS.

As to the constituent properties of our Ensilage, it would be beyond the province, and also the competency, of a layman to speak. Lord Walsingham, gratified as he might well be with the milk-pail returns of the cows, was extremely anxious to get as full and exhaustive Analyses of the ensilage as possible. We, therefore, sent two sets of samples of the food to Mr. Sutton, and samples of hay made from grass of the same description as the ensilage, for the purpose of comparison. The first set (Nos. 1) consisted of ensilage made from grass, which I have described as grown in the wood, and hay from the same kind of grass. The second set (Nos. 2) comprised ensilage made from the coarse grass grown in the meadow near the wood, and hay made from grass cut in the same meadow. The results of the Analyses are set out in the following table:—

Analysis of Two Samples of Hay and Two Samples of Ensilage.

GENERAL COMPOSITION.

	Natural State.				Dried at 212° Fahr.			
	Hay No. 1.	Hay No. 2.	Ensilage No. 1.	Ensilage No. 3.	Hay No. 1.	Hay No. 2.	Ensilage No. 1.	Ensilage No. 2.
Water	22·20	24·90	74·30	65·95				
Soluble Organic Matter	8·21	9·75	6·24	9·17	10·55	13·00	24·28	27·00
Soluble Inorganic Matter............	4·05	3·15	1·78	1·88	5·20	4·20	6·92	5·55
Insoluble Organic Matter............	61·04	58·50	16·91	22·18	78·50	77·85	65·80	65·05
Insoluble Mineral Matter............	4·50	3·70	0·77	0·82	5·75	4·95	3·00	2·40
	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00

DETAILED COMPOSITION.

	Natural State.				Dried at 212° Fahr.			
Water	22·20	24·90	74·30	65·95				
Albumen & Protein Substances, Soluble in Water*	0·73	0·88	1·60	2·12	0·94	1·17	6·22	6·23
Insoluble Protein Compounds** ...	5·03	7·09	1·41	1·43	6·46	9·45	5·49	4·20
Sugar, Gum, and Extractive Matter, Soluble in Water ...	7·48	8·87	4·64	7·05	9·61	11·85	18·06	20·73
Oil, Wax, and Chlorophyll, &c. ...	1·29	1·34	0·72	0·89	1·54	1·80	2·80	2·60
Digestive Fibre	20·80	19·80	8·28	10·62	26·73	26·35	32·24	31·17
Indigestible Woody Fibre	33·92	30·27	6·50	9·24	43·74	40·25	25·26	27·14
Soluble Inorganic Matter............	4·05	3·15	1·78	1·88	5·20	4·20	6·93	5·53
Insoluble Mineral Matter............	4·50	3·70	0·77	0·82	5·78	4·93	3·00	2·40
	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
***Containing Nitrogen**	0·115	0·140	0·255	0·336	0·149	0·186	0·992	0·990
****Containing Nitrogen**...............	0·755	1·120	0·221	0·226	1·020	1·490	0·860	0·665
Total per centage of Nitrogen ...	0·910	1·260	0·476	0·562	1·169	1·676	1·852	1·655
Equal to total Protein Compounds	5·760	7·970	8·010	3·557	7·400	10·630	11·72	10·470

Norwich, 17th Jan., 1883. **Signed,** **FRANCIS SUTTON.**

I take it that the satisfactory nature of these results is plain to the meanest capacity. But Mr. Sutton has rendered us, and I may say the whole agricultural community, essential service by appending a singularly lucid and able report to his Analyses. The importance of his conclusions, in their probable bearing upon the Ensilage controversy, could scarcely be over-rated. With what those scientists who have formed hasty and dogmatic opinions upon confessedly insufficient data may have to say to it, or how far they may hereafter be constrained, by the hard logic of facts, to modify their views, we have nothing to do. These are matters into which it is not needful, nor would it be profitable, for us to enter now. In giving publicity to this report, all I would venture to observe, by way of note or comment, is that my practical experience in the management of live stock, extending beyond a generation of time, thoroughly confirms what Mr. Sutton has so intelligently expressed.

" County Analyst's Office,
" Eastern Counties Laboratory,
" London Street, Norwich,
" January 17th, 1883.

" *Report on the Analyses of Hay and Ensilage.*

" The two samples of hay consisted of a variety of grasses many of them of a coarse description and of poor quality, and were destitute of the sweet smell and taste which always accompanies well-made meadow hay of good quality.

" The texture of No. 2 was, however, preferable to No. 1, and the grass of a somewhat finer description.

" Both specimens of ensilage were, on the contrary, highly odoriferous from the development of the essential oils peculiar to the various grasses, and had also a vinous smell accompanied with a slight but pleasant acidity.

" The smell of essential oils was so persistent that after handling the ensilage for some time it became very difficult to remove the smell by washing. On distilling some of the material with water, these essential flavours were carried over into the distillate, but, though powerful, the quantity of actual oil was too small to be separated.

"The hay, treated in precisely the same manner, gave no trace of essential oils, or any flavour whatever except that of decaying grass.

"In addition to the detailed analyses recorded in the tables, the Ensilages Nos. 1 and 2, were both examined for the amount of acidity; this was found to be very much the same in both samples, and taking it as acetic acid the proportion was found to be respectively 0·34, and 0·36, or about one third of a per cent.

"The Alcohol was estimated in No. 2 Ensilage, and amounted to 0.055 per cent. by weight, or about one tenth of a per cent. of proof spirit.

"These proportions are very small, and they arise of course from the conversion of a small proportion of saccharine matter in the original grass, but their developement is open to no objection when kept within moderate limits; on the contrary, they add to the fragrancy and taste of the substance, and undoubtedly render it more acceptable, and probably more digestible as a food.

"*If the effects of the silo were only to render what would otherwise be a tasteless, dry forage into a fragrant, appetizing, and succulent food, it would be a decided step in advance, but the analyses will shew that much greater changes of a beneficial nature occur during the process. These changes are especially shewn in the large proportions of soluble flesh formers and fat producers as compared with the hay.*

"*For instance in the case of No. 1 Ensilage the soluble albumenoids (or flesh formers) are increased more than six times, and in No. 2 more than five times; while in the case of sugar, gum, and extractive matters, the proportion is nearly doubled in both instances.*

"*The digestible fibre is also increased fully 20 per cent. in both samples of Ensilage.*

"THESE FACTS ARE OF GREAT IMPORTANCE, AND WELL WORTH THE ATTENTION OF ALL STOCK-FEEDERS, AS IT IS EVIDENT THAT THE OCCURRENCE OF THESE NUTRITIOUS CONSTITUENTS IN A READILY SOLUBLE FORM IS SO MUCH LABOUR OF MASTICATION AND DIGESTION SAVED TO THE ANIMALS WHO ARE FED ON SUCH FOOD AS COMPARED WITH DRY HAY.

"The change induced by the silo is in fact a partial digestion, or limited fermentation, and undoubtedly such food will prove much easier of digestion and assimilation than crude hay.

"There are apparently two anomalies in the figures of analysis which it may be proper to notice. The first is the apparent increase in fatty matters in the Ensilages as against the hays; this probably arises from matters like chlorophyll, &c., which are converted into a less soluble form in the process of drying through which the hay has passed.

"The second is in the amount of nitrogen found in No. 1 Ensilage as compared with its hay.

"The total protein compounds (flesh formers) are recorded as being 4 per cent. higher. This can hardly be the fact as, of course, the silo has no power to originate nitrogenous constituents: it can only modify them. The difference probably arises from one of two things—either that the sample of Ensilage taken for analysis contained rather more of the seed vessels or other richer nitrogenous portions of the plant than the corresponding sample of hay, or it may be due entirely to the different periods of growth.

"IN CONCLUSION, IT IS ABUNDANTLY EVIDENT, SO FAR AS THESE ANALYSES CAN SHOW, THAT THE SILO HAS PRODUCED A SUCCULENT, EASILY-DIGESTIBLE FOOD, FULL OF AROMA AND NUTRITION, FROM A VERY POOR QUALITY OF GRASS.

(Signed) "FRANCIS SUTTON,
"Chemist to the Norfolk Chamber of Agriculture."

CONCLUSION.

And now my story is told. I have tried to give you, in as small compass as possible, consistent with clearness, some account of the Origin, History, and Practice of Ensilage, and of the different modes of working the system, with results of experiments in various countries. If, from its character, a good deal of the matter has been dry and unexciting, I hope it has not been altogether tedious, or lacking in interest and value. I have made (this I think you will grant) no great flourishes, nor indulged in any wild flights, that could serve no practical good. As I promised at starting, I have simply described and illustrated —no doubt very imperfectly—a subject which is of vast importance in these days to the agricultural community. My general information has been drawn from dependable sources. The results of our Tests at Merton speak for themselves. Addressing practical men, I have desired, above all, to be practical, and I trust that here, at any rate, I have not failed. The facts of the case are now in evidence, and you have before you what may almost be called the unerring judgment of the stock fed upon the food. The verdict lies with you and your brother farmers. Experience in this, as in other matters, will, of course, be a safe and sure guide. If, after the encouragement you have received, you make any trials on your own account, it will be no "leap in the dark" that you will take. Our Merton experiments—and what tests could be stronger or more conclusive?—would seem to leave no doubt but that Ensilage is destined to become a new force in our Agricultural system, and one that will be profitable and serviceable to the farmer. A new chapter in Agricultural prosperity appears about to open at last; and it brings with it the promise of our being able henceforth to protect ourselves against the vexation and loss arising from invariably-damaged, and often wholly-ruined, grass and other stock-feeding crops. It is a long lane that has no turn. The road over which we have trudged has been long and dreary enough. Let us enter this new path with courage, hope, and self-reliance,—the great virtues which have sustained us in the past, which are our highest credentials in the present, and which will prove our best passports to success and prosperity in the future.

STEVENSON AND CO., PRINTERS, MARKET-PLACE, NORWICH.